

General Remarks:

Claims 2, 6-9, 11-12 and 18-20 have been cancelled without prejudice of re-submission or pursuit by way of a continuation application. Claim 1 has been amended by incorporating features from cancelled claim 2 (catalyst residence time) and claim 7 (riser reactor), along with restricting the hydrocarbon classification to alkylaromatics. Claims 3 and 17 have been amended to update dependency and be consistent with amended claim 1. Claims 4 and 5 have been amended to more clearly describe “contact times.”

Claim 9 was objected to as depending from a cancelled claim. Claim 9 has been canceled.

Rejections Pursuant to 2nd Paragraph of 35 USC 112:

Claims 1-20 stand rejected as being indefinite due to usage of terms relating to various residence and contact times. By way of further clarification, several residence and contact times are described in the specification and provided in the claims; i.e.

- (1) “average contact time” between the hydrocarbon and catalyst within the reactor;
- (2) “average contact time” between the hydrocarbon and catalyst while at reaction temperature in the separation device;
- (3) “total average contact time” in the reactor and separator device, i.e. (1) + (2);
- (4) “average residence time” of catalyst within the reactor.

As described in the specification, the claimed process utilizes very active catalysts which are capable of dehydrogenating hydrocarbons in a few seconds. In order to avoid undesired side reactions and product degradation, contact times between the catalyst and hydrocarbon are minimized – both while in contact within the reactor and while in the separation device.

Contrary to the Office’s position, the “average residence time” of the catalyst within the reactor, see (4) above, is an entirely different measure than the “average contact time” between the hydrocarbon and the catalyst, see (1) above. That is, while both the catalyst and hydrocarbon move in concurrent upward flow through the reactor in a highly fluidized manner, there is a some degree of catalyst “slip.” Thus, the “average residence time” of the catalyst in the reactor is longer than the “average contact time” between the hydrocarbon and catalyst within the reactor.

Claims 4 and 5 have been amended to further clarify the relevant “contact time” periods. Please reconsideration this indefiniteness rejection.

Rejection Pursuant to 35 USC 102(b):

Claims 1-2, 4-6, 8, 10, 13 and 14 stand rejected under 35 USC 102(b) as being anticipated by US 5,254,788 to Gartside (Gartside). Gartside discloses the dehydrogenation of light paraffins using a downer (down flow) reactor (see col. 4, line 30-35).

In distinction from Gartside, amended claim 1 is directed toward the dehydrogenation of alkylaromatic hydrocarbons with catalyst in concurrent upward flow through a dehydrogenation riser reactor. Gartside fails to disclose or suggest dehydrogenation of aromatic hydrocarbons, or the use of riser reactors. As such, amended claim 1 and all others that depend therefrom are novel. Please reconsideration this anticipation rejection.

Rejections Pursuant to 35 USC 103(a):

Claims 3 and 15-17 stand rejected as being unpatentable over Gartside in view of US 6,031,142 to Buonomo et al. (Buonomo). Buonomo discloses the dehydrogenation of alkylaromatic hydrocarbons with a gallium-based catalyst using a fluidized bed reactor.

In distinction from Buonomo, the amended claims are directed toward a process using concurrent upward flow of catalyst and hydrocarbon through a riser reactor. In further distinction, the amended claims require much shorter contact times between the catalyst and hydrocarbon, i.e. 0.5 – 10 seconds while in the reactor and \leq 10 seconds while in the separation device at reaction temperature. As yet another distinguishing feature, the catalyst residence time of the claimed process is \leq 40 seconds; whereas Buonomo describes a process having catalyst residence times of from 5-30 minutes, (see col. 3, line 46-47).

Thus, neither Gartside nor Buonomo disclose or suggest the dehydrogenation of alkylaromatic hydrocarbons using concurrent upward flow of catalyst and hydrocarbon through a riser reactor. Please reconsider this obviousness rejection. In the event the rejection is maintained, the Office is requested to provide an explanation as to why one skilled in the art would modify Gartside to operate in concurrent upward flow using a riser reactor.

Claims 9 and 18-20 stand rejected as being unpatentable over US 7,002,052 to Hamper et al. (Hamper) in view of US 6,045,688 to Ruottu et al. (Ruottu). Without conceding the merits of the rejection, claims 9 and 18-20 have been cancelled.

Applicant request reconsideration of the outstanding rejections and allowance of the amended claims.

Respectfully submitted,

/Edward W. Black/
Edward W. Black
Registration No. 36,454
Phone: 1-989-636-9067

P. O. Box 1967
Midland, MI 48641-1967
akm